WILDLAND FIRE BACKGROUND

DEFINING WILDLAND FIRE

THE TWO SIDES OF WILDLAND FIRE

Wildland fire includes two types of fire – wildfire and prescribed fire. Wisconsin **wildfires** can start through human causes such as debris burning or arson, or through natural causes such as lightning. Naturally caused wildfires are somewhat rare in Wisconsin, with most wildfires resulting from human activities. Wildfires can take lives, destroy homes and property, and leave charred landscapes. Although not planned by the landowner, wildfire can also have positive effects by helping to maintain fire dependent ecosystems.

Prescribed fires are used to mimic ecological or "natural" fires that have been part of ecosystems throughout history. Prescribed fires are ignited and controlled by land managers. When used safely and correctly they produce outcomes desired by landowners. The outcomes can include such things as restoring animal habitat, reducing fuels to prevent dangerous wildfires, and controlling pests and diseases.

COMBUSTION

Combustion is the act of burning and is a form of oxidation. Oxidation occurs when oxygen is combined with another substance. The rusting of iron ($2Fe + 3O_2 = Fe_2O_3$ + energy) is an example of oxidation. The combustion of gasoline ($2C_8H_{18} + 25O_2 = 16CO_2 + 18H_2O$ + energy) is also oxidation. As you can see in the equation, the combustion of gasoline releases energy. The energy is released from the breaking of the carbon-hydrogen bonds that hold organic compounds together. The energy released is the heat we feel when a fire burns.

Combustion can also be viewed as the opposite of photosynthesis. In photosynthesis, plants create energy from sunlight by combining water and carbon dioxide to make sugar and oxygen ($6CO_2 + 6H_2O = 6H_{12}O_6 + 6O_2$). In combustion, the sugars are broken down. The energy is released as heat, and CO_2 and H_2O are the major components of smoke.

It is important to keep in mind that this is a very simple understanding of combustion and that thousands of chemical reactions are taking place during a wildland fire. But, put simply, the heat from a fire can be seen as the same energy that plants took from the sun. Photosynthesis and combustion (as well as respiration) are the major parts of the carbon cycle – a cycle essential to all life on earth.

THE FIRE TRIANGLE

Fire behavior can be defined as the manner in which fire reacts to the environment. For fire to ignite and spread, three elements must be present – heat, fuel, and oxygen. There must be heat to start and continue the combustion process, fuel to burn, and oxygen to facilitate combustion. The three elements can be seen as sides of the fire triangle. If any one of the sides is removed, the fire will extinguish.

HEAT TRANSFER

For fire to spread, heat must move from one piece of burning fuel to another. This movement is called **heat transfer**. Heat is transferred by **radiation**, **convection**, and **conduction**. Radiant heat is heat that travels in a wave. It is the heat that warms you as you sit near a campfire or a warm stove. Convection heat is heat that moves as heated air or gas. It is the heat that rises off of a campfire or above a boiling pot of water. Conduction is heat that moves through a material. Think of a metal spoon as it comes out of a hot cup of tea. Each type of heat transfer can warm, dry, and ignite fuels.

FUEL CHARACTERISTICS

Fuel characteristics determine how intense a wildland fire burns and how far it spreads. These characteristics include the type of fuel, its chemistry, size, and shape. The quantity of fuel and the way it is arranged also influence fire behavior.

Examples of fuel include trees and tree litter, grass, shrubs, and logging slash. Light fuels, such as grass, burn very fast and hot, while heavy fuels, such as logging slash, burn for long periods of time. Light fuels dry much faster. Their moisture varies throughout the day as temperature, humidity, and wind speed changes. Often the fire danger increases during the day and decreases as night approaches.

Often, the most dangerous characteristic of fuel can be the arrangement. Fire can occur as **ground fire** (burning organic material in the soil), as **surface fire** (burning the fuels found directly on the surface of the earth), and as **crown fire** (fire that moves through the tops of trees). Fuels that reach from the ground to the crowns of trees are called **ladder fuels**. Ladder fuels can cause fire to escalate from a surface fire to a crown fire. When fire enters the crowns of trees, it becomes very dangerous and uncontrollable.

WEATHER AND TOPOGRAPHY

Weather and topography are major influences on fire behavior. Weather is constantly changing because of local, regional, and continental influences – making it difficult to predict fire behavior. Weather influences can dry fuels and cause fire to spread. The three most common weather characteristics that determine when fire danger is high are moisture in the air, temperature, and wind. As precipitation and humidity decrease, fuels become more susceptible to fire. High temperatures and winds can quickly dry fuels and feed flames.

Fuel arrangement and weather patterns are influenced by topography. The landscape can influence which fuels get direct sunlight, which fuels receive more moisture from rainfall, and which areas have more exposure to wind. Landscape features can also channel wind currents, causing extreme changes in fire behavior. Heat travels upward and can preheat and ignite fuels, causing fire to move very quickly up slopes.

EXTREME FIRE BEHAVIOR

Extreme fire behavior creates very dangerous fire situations. It can lead to wildfires that may be unpredictable and uncontrollable. Extreme fire behaviors include torching, crowning, and spotting. **Torching** occurs when a surface fire ignites the crowns of individual trees and shrubs as it advances. This type of fire is spread by an advancing surface fire. **Crowning** occurs when a fire moves into the crowns of trees. **Spotting** occurs as fires produce sparks or embers that are carried away from the fire by convection or wind currents. Spots occur as new fires start outside of the original fire area, usually ahead of the advancing fire.

THE FIRE SEASON

In Wisconsin, most dangerous wildfires occur during the months of March, April, and May. This time of year, known as the **fire season**, is especially dangerous because much of the landscape is absent of living plants, and trees have not yet grown leaves. Green plant material helps maintain moisture levels on the ground, in the shrub layer, and in the forest canopy. Without green plants, dry climate conditions, winds, and increasing temperatures can quickly dry plant material found in grassy and forested areas, creating dangerous fire conditions.

Spring is not the only time of year people in Wisconsin need to be cautious of wildfire. Dry spells throughout summer and fall can also lead to dangerous fire situations. Dangerous fire situations occur when **relative humidity** is low, winds are strong and/or constant, temperatures are high, and fuels are readily available to burn. Fire conditions are constantly monitored by the U.S. Forest Service and the Wisconsin Department of Natural Resources - Division of Forestry. (At the time of printing, the following websites contained up-to-date information on fire conditions – *http://activefiremaps.fs.fed.us* and *www.dnr.state.wi.us/org/land/forestry/Fire/index.htm*.)

FIRE ECOLOGY

Wildland fire harms some species and benefits others, while some species remain unaffected. The interaction between fire and different species causes short and long-term changes in ecosystem functions, forest structure, and ecosystem composition.

Wildland fire influences **ecosystem functions**. Ecosystem functions support life. They include the fixation of energy, the flow of energy through food webs, and the cycling of matter. A very hot fire can remove seed sources and sterilize soil. In such cases, it may take years for a forest to return. A wildland fire that is less extreme can mineralize (decompose) organic material such as leaves, sticks, and logs very quickly – making nutrients available to plants. The process of decomposition that normally occurs on the forest floor can take years, and even decades, without wildland fire. Wildland fire can clear forest trees, shrubs, and other organic material. This increases sunlight penetration and stimulates plant growth, fixing energy into an ecosystem through photosynthesis.

New plant growth after wildland fire provides food to many types of animals. Food webs can be dramatically altered by wildland fire.

Wildland fire changes **forest structure**. Forest structure is the vertical and horizontal spacing of trees in a forest. Vertical layers are the overstory and the understory. Horizontal spacing is the density of tree cover across the landscape. The overstory consists of the largest trees in the forest that capture direct sunlight. The understory consists of smaller trees, shrubs, and herbaceous plants. Below the understory is the leaf litter and the topmost, organic-rich soil layer known as duff. All aspects of forest structure can be altered by wildland fire. For example, over time, fire could change a dense mixed hardwood forest into an oak savanna with widely spaced trees and a grassy understory.

Wildland fire changes the **composition** of an ecosystem. The type and distribution of plants and animals in an area is altered by wildland fire. Many plants cannot survive wildland fire. Maple species are a good examples of plants that cannot survive fire. Plants can also be resistant or resilient to wildland fire. A good example of a resistant plant is a large oak tree. The thick bark on an oak tree protects the living **cambium** from fire's heat. When many other trees and plants die in a wildland fire, large oak trees will remain. Another good example of a resilient plant is a jack pine tree. Wildland fires often destroy entire jack pine stands. Individual jack pine trees cannot survive the heat of a wildland fire. However, jack pine cones open and release seeds during periods of high heat ensuring that jack pine trees will recolonize after a fire.

In general, wildland fire in Wisconsin influences ecosystems in predictable ways. The following summaries of ecosystem responses to fire apply to ecosystems in Wisconsin that are fire dependent and fire tolerant. Though there are often exceptions, the summaries are very useful for understanding the ecological role of fire.

FIRE EFFECTS ON VEGETATION

- Increase in species diversity.
- Increase in biomass production.
- Short-term increase in annual and biennial species.
- Increase in flower, seed, fruit, or nut production.
- Improved forage quality, both in nutrition and palatability.
- Long-term shift in dominance away from plants with most of their biomass above ground to plants with most of their biomass below ground.

FIRE EFFECTS ON ANIMALS

- Initial drop in numbers and species resulting from mortality among invertebrates, reptiles, and small mammals.
- Eventual increase in animal numbers and species resulting from the increase of plant productivity and improved habitat structure.
- Should a species be totally removed or driven out from a site after a fire, it will recover only if individuals from another site are close enough to recolonize it.

FIRE EFFECTS ON SOIL

- Reduction in litter, duff, and humus layers above the mineral soil surface, resulting in warmer soil temperatures.
- Increase in fertility and organic matter within the mineral soil resulting from increased plant root and soil microorganism activity.

WISCONSIN FIRE DEPENDENT ECOSYSTEMS

Fire has been an important part of forest and grassland ecosystems in central and eastern North America for 25 to 30 million years. Many plants and animals have adapted to survive and flourish after wildland fires. For the past five to six thousand years, half the state of Wisconsin has been covered by fire dependent and fire tolerant ecosystems such as prairies, sedge meadows, oak savannas, and pine barrens. Periodic distributed fire has created a mosaic of ecosystems across the landscape – with some ecosystems isolated from wildland fire and others periodically exposed. Wisconsin's ecosystem diversity depends on the periodic occurrence of wildland fire. For more information on specific Wisconsin fire dependent ecosystems, see the LEAF website fire section at *www.leafprogram.org*.

WILDLAND FIRE AND SOCIETY

HUMANS AND FIRE

For wildfires to occur, a source of ignition is needed. In Wisconsin, human activities cause the majority of wildfire ignitions. On average, 97 percent of wildfires each year in Wisconsin are caused by humans. Outdoor burning, sparks from railroads, machinery, and many individual and group activities that occur in rural, forested or grassland areas can cause accidental wildfires. Often these activities involve fireworks, campfires, off-road vehicles, and use of gas-powered tools such as lawnmowers and chain saws. In some instances, wildfires are caused by natural sources such as lightning and microbial activity.

FIRE REGIMES

Regions in Wisconsin differ in **climate**, **topography**, **land cover**, **land use**, and land use history. These differences create distinct fire regimes. A **fire regime** is a cultural and biological system that defines the distribution, intensity, and frequency of fires in a given area. As suggested by the definition, there are two components to a fire regime – human activity and natural processes.

Both human and natural influences change over time. Forest **succession** and **climate change** are examples of natural processes that cause changes on the landscape over time. **Species introduction** and **land conversion** are examples of human activities that cause change.

The relationship between humans and the landscape is complex. It is well understood that today's human activities will influence future fire regimes. We are currently living in fire regimes shaped by the activities of human populations that came before us. An understanding of fire regimes, including both natural and human history, is necessary to manage ecosystems and to reduce the risk of catastrophic fire.

WISCONSIN'S HUMAN FIRE HISTORY

After the recession of the last glaciers, approximately 10,000 years ago, Native American populations migrated into Wisconsin. By the late 1400s, Wisconsin's native population was estimated at 60,000 people. Native people used fire to corral and hunt animals, to create animal habitat, and to clear areas for agriculture. These fires played a partial role in influencing Wisconsin's land cover. In the south, these fires expanded grasslands, prairies, and savannas. In the north, the many small fires cleared trees and shrubs, making way for sun-loving trees and plants. This expanded the patchwork of tree stands with different ages, structures, and compositions that were common across northern Wisconsin.

As European settlers moved to Wisconsin, they began to log, farm, and build towns. The widespread logging in the north and the conversion of the prairies in the south changed the fire regimes. In the north, many small fires were allowed to burn by populations who felt that as long as the fires weren't near their homes, they were only helping clear more farmland. On occasion, the small fires turned into large, intense fires fueled by the dead trees and slash left behind after logging. The extent and intensity of the fires was much greater than the fires started by Native American populations.

The most significant fire in Wisconsin's history was the Peshtigo Fire of 1871 that burned in Wisconsin and Michigan. The fire killed as many as 1,500 people and burned 1.5 million acres. In 1887, a wildfire nearly wiped out the city of Marshfield. In 1894, the Comstock Fire burned 64,000 acres in Barron and Washburn Counties, and the Phillips Fire burned 100,000 acres in Price County. Many other larger fires ravaged the state during this time, but the only documentation is in survey notes, personal journals, and newspaper clippings. Prior to 1930, it is estimated that some 2,500 fires burned half-a-million acres each year.

In the southern part of Wisconsin, the occurrence of fire was reduced due to agriculture. The conversion of land to agriculture and the decrease in fire reduced habitat for many of the large animals that lived in southern Wisconsin at the time. Bison, elk, and cougar that depended on the grasslands, prairies, and savannas were **extirpated** from the landscape.

With the hiring of E. M. Griffith as superintendent of forestry in Wisconsin in 1904, fire control efforts began in earnest. In 1905, Griffith appointed 249 town fire wardens around the state. Over the next 50 years, federal and state agencies, as well as county governments, developed the infrastructure for statewide fire control. A cooperative system of fire towers, radio communications, chartered aircraft, plows, tankers, and paid and volunteer fire fighters was put into place. Through the 1920s, 1930s, and 1940s, fire control efforts gained another powerful tool – fire prevention. In 1944, scattered prevention efforts were unified and nationalized with the use of Smokey Bear. His story and message helped fire prevention and control efforts become more effective.

Today, it is accepted that the effectiveness of fire prevention and suppression has had an impact on forest and grassland ecosystems that depend on fire to maintain their existence. Forest and grassland ecosystems that depend on fire have been severely reduced in size. Periodic fire thins many forests by clearing small trees and shrubs. In the absence of fire, some forests have grown thick with small trees that can fuel very intense wildfires.

In recent years, forest management has proven to be an effective way to reduce fuel buildup and decrease the risk of catastrophic fire. Prescribed fire has been shown to be a safe way to reduce fuel buildup as well as manage fire dependent ecosystems. The safe and correct use of prescribed fire and forest management is increasing, but their benefits are often unknown or misunderstood by the public.

THE COTTONVILLE FIRE

On May 5, 2005, Wisconsin's largest wildland fire in 25 years burned in Adams County, Wisconsin. Since 1932, there have been 41 major fires in the Adams County area. Jack and red pine cover much of this area and are extremely flammable during low moisture periods. Ignition of the fire was started by a human who was burning debris during a dry, warm, and windy day. The fire escaped his control and spread for 11 hours. The fire burned 3,410 acres, 30 homes, 60 outbuildings, and millions of dollars worth of timber. Suppression costs of the fire alone cost more than $287,000. This fire may have been avoided if the individual had followed the guidelines listed on the burning permit he was issued.

WILDLAND FIRE MANAGEMENT

AGENCIES RESPONSIBLE

In Wisconsin, wildland fire management is achieved through cooperation among Wisconsin citizens and municipal, county, state, and federal agencies. The cooperation of local police and fire departments with state and national agencies is essential to wildfire control. In Wisconsin, local fire departments, the Wisconsin Department of Natural Resources, the U.S. Forest Service, the U.S. Fish and Wildlife Service, and agencies from neighboring states all cooperate to manage wildland fire. All these agencies depend on funding from local, state, and federal taxes.

Wildland fire management uses the principles of fire behavior and an understanding of human fire practices to eliminate unwanted fires and promote beneficial ones. The goal of wildland fire management can be cultural (e.g., to protect historic sites from wildfire), ecological (e.g., to use controlled fire to maintain animal habitat), and economic (e.g., to protect property).

WILDFIRE PREVENTION

Wildfire prevention is a strategy used to reduce damage from fire through education, engineering, and enforcement methods. These fundamental steps help prevent accidental ignitions and reduce fire **risks** and **hazards**.

For more than 50 years, Smokey Bear has been at the forefront of wildfire education. Though the Smokey Bear prevention programs are the most visible, many other fire prevention programs exist for K-12 students. A variety of state and national agencies have developed educational materials that advance fire safety messages, help students understand fire ecology, promote the benefits of prescribed fire, and advertise career opportunities in wildland fire management.

It is important that both children and adults understand that outdoor fires can ignite and spread very rapidly. Throughout Wisconsin's history, many destructive fires were started accidentally and grew quickly beyond the control of citizens and sometimes even firefighters. The Cottonville Fire in May of 2005 is a modern example of an accidental ignition, attempted control by a landowner, and a fire that grew rapidly out of control.

Education and engineering methods are used in tandem to protect communities from the risks of wildfire. The Firewise Communities program has been very successful in educating homeowners about the proper location, construction, and landscaping of homes to reduce the risks of wildland fire.

The state of Wisconsin enforces forest fire regulations and restrictions. The regulations make the following activities unlawful:

- Burning without a permit, if required
- Burning materials other than wood, leaves, brush, grass, cardboard, and dry paper
- Failure to extinguish fires
- Allowing fire to escape
- Arson
- Destruction of property
- Negligent handling of burning material

Burning debris is the number one cause of accidental fire in Wisconsin. Burning permits are required in many parts of the state to conduct outdoor burning. Burning permits are free and can be obtained by contacting a local DNR office, emergency fire warden, or local fire official.

WILDFIRE SUPPRESSION

Wildfire suppression involves both **presuppression** activities and the active **suppression** of unwanted fire. Without presuppression preparation, the control of wildfire can be difficult or impossible.

Presuppression activities are conducted to reduce wildfire risk and prepare fire suppression forces. Presuppression activities include the construction and maintenance of roads, airports, and water infrastructure, the training of fire suppression teams, the management of fire prone forests, and the development and testing of suppression equipment.

When a wildfire occurs, fire suppression forces act to protect human life, property, and natural resources – in that order of priority. To accomplish these goals, fire suppression teams use three main strategies – evacuation, fire containment, and structural protection.

Evacuation is conducted to protect human life in and around a fire area. The first evacuation priority is to evacuate people from the fire area and fire path. In many instances wildfires have already engulfed or are threatening homes as firefighters arrive on the scene. Evacuation is often difficult because people do not want to leave their possessions. Fire evacuation requires that an area be designated and maintained to supply evacuees with food, shelter, and information. The shelter is often the area where officials communicate with local residents. To ensure the safety of local residents, news media, and sightseers, the fire perimeter needs to be secured. Local and state police often post officers at all entry roads into a fire area.

As evacuation efforts begin, an incident command center is established to coordinate fire suppression resources and provide information to the news media. Fire suppression teams then plan and initiate fire containment strategies to slow and stop the spread of wildfire. In Wisconsin, a widely used fire containment strategy is fuelbreak construction. Creating a “fuelbreak” or “fireline” involves removing the flammable organic matter found on or near the surface of the ground (e.g., plants, leaves, sticks, and black soil) to expose the mineral soil. Surface fires do not spread in mineral soil. Breaks are constructed to contain the lateral spread of fire. They can be constructed by crews using specialized hand tools or with heavy equipment.

Fire containment also involves the use of water and fuel reduction. The application of water reduces fuel temperatures and limits the oxygen available to a fire. Water can be applied on or in front of the fire using aircraft, heavy trucks, pumps from nearby water sources, and backpack water cans. Removing fuels in front of a fire reduces the fire intensity and improves the effectiveness of water use and line construction.

Fuels can be removed by clearing vegetation, but are also removed by lighting surface fires in the wildfire path. The fires burn away much of the ground level fuel, and when lit correctly, can deprive the wildfire of oxygen.

In tandem with evacuation, fire suppression crews protect structures, placing priority on homes and other buildings that have adequate defensible space. Suppression crews create breaks around structures and apply water from aerial drops by airplanes, heavy trucks, or local water sources. The effectiveness of structural protection depends on building and landscape design, housing patterns, and the intensity and behavior of the fire.

PRESCRIBED FIRE

Prescribed fire is an effective management tool that land managers can use to manipulate vegetation. Fire can be used to create and maintain animal habitat and reduce the risk of wildfire from an overabundance of fuels.

Prescribed fire is essential to the health of many Wisconsin ecosystems. For the 5,000 years prior to European settlement, half the state was covered by fire dependent ecosystems. Today, though, there is a higher frequency of fires and the size of the fires is much smaller, averaging about 10 acres in size. Wisconsin's pre-European history was characterized by infrequent, but very large fires (often greater than 10,000 acres). The large fires sustained ecosystems such as prairies and oak savannas.

Aggressive fire suppression policies protect property and investments and make much of Wisconsin's landscape safe for homes and businesses. This has come at a cost to native ecosystems. As fire has been removed from the landscape, ecosystems have changed, often limiting habitat for certain plants and animals and creating dangerous fire conditions due to the buildup of fuels.

In Wisconsin, an estimated 12,000 to 22,000 acres are purposefully burned using prescribed fire each year. By controlling the timing, frequency, and intensity of fire, fire managers have shown that they can create and sustain fire dependent ecosystems. Through rigorous safety precautions such as monitoring weather and fuel conditions, notifying adjacent landowners, and having suppression crews on-hand, fire managers have shown that prescribed fire is also very safe.

THE WILDLAND/URBAN INTERFACE

Over the last few decades, more and more people have abandoned city and suburban living for a more rural setting. In Wisconsin, new rural houses serve as permanent or seasonal homes and are often found in forested areas. Unfortunately, not everyone adapts to the fire danger that exists in wildland areas and protects their home and property correctly.

Today, not only do firefighters have to deal with the wildland fuels, but the structures that are mixed in with them as well. This area has come to be known as the Wildland/Urban Interface (WUI) and it is one of the biggest challenges to wildland and structural fire agencies. The simple fact is that in the event of a large fire, there will not be enough resources to protect every home.

Put yourself in the driver's seat of a fire truck at the scene of a large fire. Depending on the area, hundreds of homes may be threatened over the course of the fire. Your first priority is the safety of your personnel and citizens in the area. You may have many homes assigned to you to attempt to protect either before or after the fire front passes.

With the water you have, you can probably wet down two or three homes before having to refill your truck with water. On top of all this, you have limited visibility due to smoke, constant radio communications, the confusion of a panicked citizenry evacuating the area, and others trying to enter the area to get a firsthand look. Since time will not allow you to give attention to all the structures in your area before the fire arrives, you must determine where you can safely send your vehicle and personnel.

Unfortunately, even though housing in the WUI is increasing, the number of available firefighters and equipment is not increasing at the same rate. Oftentimes, firefighters in fire prone areas are working as volunteers and may not be fully aware of the potential problems in a community they are helping to protect.

Homeowners and fire officials can form a partnership to increase safety in the WUI. In this situation, homeowners take principle responsibility for assuring low home ignitability. Fire officials provide technical assistance as well as emergency response. The ideal situation is for homes to be designed, built, and maintained to withstand a wildfire without the intervention of the fire department. Homeowners can achieve this by following **Firewise practices**.

Firewise practices focus on three main areas to help property be compatible with the surrounding land – access, the surrounding vegetation and the structure itself.

ACCESS

Would firefighters be able to get to your home if there were a fire in the area? Driveways should be at least 12 feet wide with 14 feet of overhead clearance. Driveways longer than 150 feet or with sharp curves may need to be closer to 20 feet wide. A locked or closed gate can make entry to property impossible.

THE SURROUNDING VEGETATION
How easily can a fire spread from the adjacent vegetation to your home? The area within approximately 30 feet around all structures is thought of as a home's **defensible space**. If modified properly, this area can keep low-intensity surface fire from reaching structures. It can also provide a relatively safe area for firefighters to work in if they are able to help protect a home. This area should be kept mowed short, raked free of fallen leaves and needles, and green throughout the growing season. Remember that spring is when most wildfires occur in Wisconsin; cleanup at this time of year is essential.

THE STRUCTURE ITSELF
How flammable is your home? Any building on a property is potential fuel in a wildfire including garages, campers, and storage sheds. Anything attached to a structure is part of the structure. Roofs, rain gutters, and decks are natural traps for leaves, pine needles, and embers from a fire. These areas should be kept free of all material that could allow an ember to smolder and start a fire. Do not store flammable materials or allow debris to fill in under decks and overhangs. Chimneys, eaves, and vents should be kept covered with wire mesh to keep embers from blowing into structures.

To learn if your community is at risk, visit *www.fws.gov/fire/downloads/listedriskcomm.pdf*.

CAREERS IN WILDLAND FIRE

As development in rural, forested, and grassland areas increases, so does the need for professionals working in the field of wildland fire management. In addition, the effectiveness of prescribed fire and its increased use by many land managers requires professional training.

There are many career paths available in wildland fire management ranging from highly technical careers in research to education and public policy. Careers in wildland fire management include the following fields:

- **Forest Management:** Forestry professionals manage forested areas to reduce the risk of catastrophic fires, produce timber, and sustain forest services.
- **Range Management:** Rangeland professionals manage grasslands for livestock production and habitat conservation.
- **Fire Suppression:** Wildland and structural firefighters control accidental wildfires to protect lives, property, and natural resources.
- **Fire Education:** Communication and education professionals help people take positive actions to prevent destructive wildfire, protect their communities, and ensure that fire remains a part of the ecological landscape.
- **Fire Ecology:** Biologists study and manage ecosystems to sustain native plant and animal communities.
- **Research and Development:** Scientific researchers develop and test technologies and innovations to suppress fires, protect homes, and protect firefighters.
- **Land Use Planning:** Natural and human resource professionals work cooperatively to determine methods and policies to make human communities more compatible with fire prone landscapes.

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